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| EXAMINER | |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/607,074 | FOO ET AL. | |
| | Examiner | Art Unit | |
| | THOMAS M. REDDING | 2624 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *25 June 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Objections*

1. Claim 28 is objected to because of the following informalities: Line 2 of claim 28 recites the phrase "communication with" twice in succession. This appears to be a typographical error. Appropriate correction is required.

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spigarelli et al. (US 4,914,513) and further in combination with Chang et al. (US 6,393,942).

Regarding claim 1, Spigarelli discloses [a] method of processing an electronic assembly, comprising:

capturing an image of a contact formation on a surface of a semiconductor package (Spigarelli, figure 1, contacts are visible to the camera - 10), the semiconductor package including a microelectronic die with an integrated circuit formed therein ("to achieve the exact alignment of the I.C. contacts and the circuit board sockets or solder pads", Spigarelli, column 1, line 66, Spigarelli is placing an integrated circuit), the image

having a width and a captured contact point corresponding to an actual contact point on the contact formation ("The undivided overhead view 22 of the work area permits the viewer to accurately align the integrated circuit contact leads 24 with the corresponding pads 26 on circuit board", Spigarelli, column 2, line 34); and placing the semiconductor package on a circuit board having a socket such that the actual contact point is in a selected position relative to the socket ("using for example a pick-and-place head, to achieve the exact alignment of the I.C. contacts and the circuit board sockets or solder pads", Spigarelli, column 1, line 66).

While Spigarelli discloses imaging the contacts of the device, Spigarelli does not provide detail on the resolution he uses.

Chang, working in the same problem solving area of imaging ball grid array devices, does teach imaging contacts comprising a plurality of pixels, the pixels having side lengths of at least 20 percent of the width of the image ("A minimum workable ball size for purposes of detecting a ball feature is 3 pixels in diameter", Chang, column 4, line 51, 3 pixels corresponds to pixel length to contact width of around 33%).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the use the resolution criteria taught by Chang in the component alignment system of Spigarelli to insure detecting a ball feature ("A minimum

workable ball size for purposes of detecting a ball feature is 3 pixels in diameter", Chang, column 4, line 51).

3. Claims 2-6 and 18, 19, 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spigarelli et al. (US 4,914,513) and Chang et al. (US 6,393,942), further in combination with Mitsumoto (US 2003/0133603).

The combination of Spigarelli and Chang teaches the elements of claim 1 as given above.

The combination of Spigarelli and Chang does not explicitly teach picking the semiconductor package from a support.

Mitsumoto does teach picking the semiconductor package from a support ("an electronic component mounting apparatus for mounting a plurality of electronic components fed from an electronic component feeding unit onto a circuit board", Mitsumoto, paragraph 37, and figure 6, reference 16).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to supply parts from a feeding system as taught by Mitsumoto in the component alignment system of the combination of Spigarelli and Chang to provide

a ready supply of parts presented for easy pickup by the automated handling equipment.

Regarding claim 3, the combination of Spigarelli, Chang and Mitsumoto teaches suspending the surface of the semiconductor package within a field of view of the camera (Spigarelli, figure 1, IC – 18, is within the field of view of the camera – 10).

Regarding claim 4, the combination of Spigarelli, Chang and Mitsumoto as given above teaches all the elements of claim 3.

The previous combination does not teach wherein the image is captured with a CCD camera.

Mitsumoto does further teach wherein the image is captured with a CCD camera ("The image pickup device 14 is equipped with lenses 7 for each forming an image of the electronic component 2 and CCDs 9 as one example of the image pickup devices for picking up the images formed by the lenses 7", Mitsumoto, paragraph 132).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use a CCD camera as taught by Mitsumoto in the alignment system of the combination of Spigarelli, Chang and Mitsumoto as CCD cameras were well known and commonly used in this type of application ("Conventionally, in an electronic component mounting apparatus for mounting electronic components such as chip components or IC chips on a circuit board, by recognizing states that the electronic

components are sucked and held by suction nozzles at a head by images picked up by using an image pickup device such as a CCD camera", Mitsumoto, paragraph 3).

Regarding claim 5, the combination of Spigarelli, Chang and Mitsumoto teaches all the elements of claim 4 as given above.

This previous combination does not teach wherein the contact formation has a surface comprising a first area and a second area.

Chang does further teach wherein the contact formation has a surface comprising a first area and a second area ("The Hough locator, as known in the art, generally works better locating balls on devices that have a light background, i.e. where the device body is lighter than the balls being located", Chang, column 7, line 19, the devices Chang works with have a package background making up one area, and ball surfaces that make up a another).

It would have been obvious at the time the invention was made to use the Ball Grid Array devices taught by Chang as a subject for the alignment system of the combination of Spigarelli, Chang and Mitsumoto since producing circuit boards with BGA devices have similar problems as working with other types of IC devices ("In the electronics industry in particular, it is often necessary to align a small component in a precise predetermined position on a work surface. For example, when connecting an integrated circuit device to a printed circuit board, the I.C. contact leads or pads oppose corresponding circuit board sockets or solder pads. If precise alignment is not achieved, a necessary contact may not be effected and the I.C. must be removed from the circuit

board and replaced thereon in the correct position", Spigarelli, column 1, line 13 and "A minimum square error transformation is used in the least square fit to provide a more accurate actual device location. The device location can then be manipulated by pick and place hardware in order to place the device in its proper location/destination, e.g. for assembly on a PCB", Chang, column 4, line 35, Chang describing tasks involved in assembly using BGAs).

Regarding claim 6, the combination of Spigarelli, Chang and Mitsumoto teaches where in the first area is a normal brightness area and the second area is a dull brightness area ("The Hough locator, as known in the art, generally works better locating balls on devices that have a light background, i.e. where the device body is lighter than the balls being located", Chang, column 7, line 19, the devices Chang works with have a package background making up one area, and ball surfaces that make up a another, and they respectively have different brightnesses).

Regarding claim 18, the combination of Spigarelli, Chang, and Mitsumoto teaches [a] method of processing an electronic assembly, comprising:

capturing an image of a contact formation on a surface of a semiconductor package with a CCD camera ("The image pickup device 14 is equipped with lenses 7 for each forming an image of the electronic component 2 and CCDs 9 as one example of the image pickup devices for picking up the images formed by the lenses 7", Mitsumoto, paragraph 132),

the semiconductor package including a microelectronic die with an integrated circuit formed therein ("to achieve the exact alignment of the I.C. contacts and the circuit board sockets or solder pads", Spigarelli, column 1, line 66, Spigarelli is placing an integrated circuit),

the contact formation having a surface with an actual contact point, the image having an captured contact point corresponding to the actual contact point on the outer surface ("The raw feature finding processor uses a feature finding algorithm such as a Hough transform or Cognex Blob Tool to find ball features (irrespective of number) and generate a list of raw features (in physical space) in the form of an X and Y location for each feature located", Chang, column 3, line 52, the x and y location corresponds to the feature center, each feature will have an estimated center and an actual center. There is a one-to-one correspondence);

and placing the semiconductor package on a circuit board having a socket such that the actual contact point is in a selected position relative to the socket ("using for example a pick-and-place head, to achieve the exact alignment of the I.C. contacts and the circuit board sockets or solder pads", Spigarelli, column 1, line 66).

Regarding claim 19, the combination of Spigarelli, Chang, and Mitsumoto teaches wherein the actual contact point is an actual center of the contact formation and the captured contact point is a captured center of the image ("The raw feature finding processor uses a feature finding algorithm such as a Hough transform or Cognex Blob Tool to find ball features (irrespective of number) and generate a list of raw features (in

physical space) in the form of an X and Y location for each feature located", Chang, column 3, line 52, the x and y location corresponds to the feature center, each feature will have an estimated center and an actual center. ).

Regarding claim 24, the combination of Spigarelli, Chang, and Mitsumoto teaches [a]n apparatus for processing electronic assemblies, comprising:

a frame (Mitsumoto, figure 6, reference 102);

a semiconductor package support secured to the frame to support a semiconductor package (Mitsumoto, figure 6, reference 16 – electronic component feeding unit),

the semiconductor package having a surface with a contact formation thereon and including a microelectronic die with an integrated circuit formed therein ("to achieve the exact alignment of the I.C. contacts and the circuit board sockets or solder pads", Spigarelli, column 1, line 66, Spigarelli is placing an integrated circuit);

a CCD camera, having a field of view, connected to the frame to capture an image of the contact formation ("The image pickup device 14 is equipped with lenses 7 for each forming an image of the electronic component 2 and CCDs 9 as one example of the image pickup devices for picking up the images formed by the lenses 7", Mitsumoto, paragraph 132 and figure 17, reference 204);

a printed circuit board support secured to the frame to support a printed circuit board, the printed circuit board having a socket (Mitsumoto, figure 6, reference 17 – circuit board); and

a pick-and-place head connected to the frame for movement to pick the semiconductor package from the semiconductor package support (Mitsumoto figure 6, reference 101 – head unit),

suspend the semiconductor package so that the surface of the semiconductor package is in the field of view of the CCD camera (Spigarelli, figure 1, IC – 18, is within the field of view of the camera – 10),

and place the semiconductor package in the socket on the printed circuit board ("using for example a pick-and-place head, to achieve the exact alignment of the I.C. contacts and the circuit board sockets or solder pads", Spigarelli, column 1, line 66).

Regarding claim 25, the combination of Spigarelli, Chang, and Mitsumoto teaches wherein the CCD camera has a focal length and the pick-and-place head is connected to the frame such that it suspends the semiconductor package in the field of view of the CCD camera so that the surface of the semiconductor package is at the focal length of the CCD camera (Spigarelli, figure 1, IC – 18, is within the field of view of the camera – 10, it is inherent to the system that the component would be presented at a focal length from the camera array in order to have an in focus image)

4. Claims 7-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spigarelli et al. (US 4,914,513), Chang et al. (US 6,393,942), and Mitsumoto (US 2003/0133603) further in combination with Swab (US2003/0066952).

The combination of Spigarelli, Chang and Mitsumoto teaches all the elements of claim 6 as given above.

The combination of Spigarelli, Chang, and Mitsumoto does not teach wherein the captured image includes only the normal brightness area of the outer surface of the contact formation.

Swab, working in the same problem solving area of imaging ball grid arrays, does teach wherein the captured image includes only the normal brightness area of the outer surface of the contact formation ("Consequently, the part is visualized in the formed image with a substantial contrast between metallic objects and background, e.g. the metallic objects appear black, whereas the background appears white or light colored, allowing for reliable computer vision recognition of the metallic objects", Swab, paragraph 12, the image only picks up light from the area surrounding the contacts, not the contacts themselves.

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the polarization method taught by Swab in the alignment system of the combination of Spigarelli, Chang and Mitsumoto "to improve the visualization, and thus the rate of successful recognition, of white or light colored ceramic BGAs" (Swab, paragraph 11).

Regarding claim 8, the combination of Spigarelli, Chang, Mitsumoto and Swab teaches wherein the contact formation has an outer edge and an actual center (Chang, figures 2A-C, the contacts of a BGA are spherical and thus the image has a circular outer edge and an actual center).

Regarding claim 9, the combination of Spigarelli, Chang, Mitsumoto and Swab teaches all the elements of claim 8 as given above.

The combination as given above, although describing the idea of positioning BGA devices does not describe the details for determining a BGA orientation in particular it does not teach defining an outer edge of the captured image and determining a captured image center.

Chang further teaches defining an outer edge of the captured image ("Cognex Blob Tool, as known in the art, can be selected to find ball features by segmentation via grey level thresholding 36, in which the image pixels are partitioned into regions that correspond to meaningful objects, i.e. balls in the grid", Chang, column 7, line 23, Segmentation involves finding the boundaries between shapes and would therefore determine edges of the contacts) and determining a captured image center ("The raw feature finding processor uses a feature finding algorithm such as a Hough transform or Cognex Blob Tool to find ball features (irrespective of number) and generate a list of raw features (in physical space) in the form of an X and Y location for each feature

located", Chang, column 3, line 52, the x and y location corresponds to the feature center).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the BGA analysis method disclosed by Chang in the alignment system taught by the combination of Spigarelli, Chang, Mitsumoto and Swab since producing circuit boards with BGA devices have similar problems as working with other types of IC devices ("In the electronics industry in particular, it is often necessary to align a small component in a precise predetermined position on a work surface. For example, when connecting an integrated circuit device to a printed circuit board, the I.C. contact leads or pads oppose corresponding circuit board sockets or solder pads. If precise alignment is not achieved, a necessary contact may not be effected and the I.C. must be removed from the circuit board and replaced thereon in the correct position", Spigarelli, column 1, line 13 and "A minimum square error transformation is used in the least square fit to provide a more accurate actual device location. The device location can then be manipulated by pick and place hardware in order to place the device in its proper location/destination, e.g. for assembly on a PCB", Chang, column 4, line 35, Chang describing tasks involved in assembly using BGAs).

Regarding claim 10, the combination of Spigarelli, Chang, Mitsumoto and Swab teaches wherein the captured image center corresponds to the actual center of the contact formation ("The raw feature finding processor uses a feature finding algorithm such as a Hough transform or Cognex Blob Tool to find ball features (irrespective of

number) and generate a list of raw features (in physical space) in the form of an X and Y location for each feature located", Chang, column 3, line 52, the x and y location corresponds to the feature center, each feature will have a real center and an actual center. There is a one-to-one correspondence).

Regarding claim 11, the combination of Spigarelli, Chang, Mitsumoto and Swab teaches wherein the contact formation is substantially spherical (Chang, figures 2A-C, the contacts of a BGA are spherical and thus have an outer edge and an actual center).

Regarding claim 12, the combination of Spigarelli, Chang, Mitsumoto and Swab teaches wherein there are a plurality of contact formations on the surface of the semiconductor package (Chang, figure 2A – shows a set of patterns that the contacts on BGA devices can occur in).

Regarding claim 13, the combination of Spigarelli, Chang, Mitsumoto and Swab teaches wherein the contact formations are BGA solder balls ("Ball Grid Array devices ( BGA) are surface mount devices in a package having an exterior mounting surface that consists of a set of solder balls arranged in a grid pattern", Chang, column 3, line 4).

Regarding claim 14, the combination of Spigarelli, Chang, Mitsumoto and Swab teaches wherein the contact formation has a diameter of approximately 0.55 mm ("A BGA or Ceramic Ball Grid Array (CBGA) is a commonly used component or package in

Surface Mount Technology (SMT). The bottom of the part is formed by high melt small (e.g. a fraction of a mm in diameter) solder balls ...", Swab, paragraph 7).

5. Claims 15-17, 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spigarelli et al. (US 4,914,513), Chang et al. (US 6,393,942), Mitsumoto (US 2003/0133603) and Swab (US2003/0066952) further in combination with Frutschy et al. (US 2003/000739) and evidentiary reference Chiu (US 2003/0150645).

Regarding claim 15, the combination of Spigarelli, Chang, Mitsumoto and Swab teaches all the elements of claim 14 as given above.

The combination of Spigarelli, Chang, Mitsumoto and Swab does not explicitly teach wherein the semiconductor package is a microprocessor.

Frutschy, working in the same problem solving area of attaching components to a printed circuit board does teach wherein the semiconductor package is a microprocessor ("IC 306 contains one or more circuits, which are electrically connected to conductive structures within IC package 308 through connectors, such as ball grid array connectors. IC 306 could be any of a number of types of integrated circuits. In one embodiment of the present invention, IC 306 is a microprocessor", Frutschy, paragraph 30).

It would have been obvious at the time the invention was made to assemble microprocessors to motherboards as taught by Frutschy, using the system of the combination of Spigarelli, Chang, Mitsumoto and Swab as sockets are often used to mount a BGA or PGA to a PCB, to provide greater parts interchangeability and reworkability (Chiu, paragraph 4).

Regarding claim 16, the combination of Spigarelli, Chang, Mitsumoto, Swab and Frutschy teaches wherein the circuit board is a motherboard ("PC board 312 could be, for example, a motherboard of a computer or other electronic system. PC board 312 acts as a vehicle to supply I/O signals to IC 306", Frutschy, paragraph 33).

Regarding claim 17, the combination of Spigarelli, Chang, Mitsumoto, Swab and Frutschy teaches wherein the socket has a plurality of conductor pads formed therein and when the semiconductor package is placed within the socket, the actual contact point of each contact formation contacts a conductor pad in the socket ("IC package 308 is electrically coupled to socket 310 using ball grid or land grid array connections", Frutschy, paragraph 31).

Regarding claim 20, the combination of Spigarelli, Chang, Mitsumoto, Swab and Frutschy teaches wherein the semiconductor package is a microprocessor (IC 306 could be any of a number of types of integrated circuits. In one embodiment of the present invention, IC 306 is a microprocessor", Frutschy, paragraph 30) and the circuit

board is a motherboard ("PC board 312 could be, for example, a motherboard of a computer or other electronic system. PC board 312 acts as a vehicle to supply I/O signals to IC 306", Frutschy, paragraph 33).

Regarding claim 21, the combination of Spigarelli, Chang, Mitsumoto, Swab and Frutschy teaches [a] method of processing a semiconductor package, comprising:

picking a microprocessor from a support ("an electronic component mounting apparatus for mounting a plurality of electronic components fed from an electronic component feeding unit onto a circuit board", Mitsumoto, paragraph 37, and figure 6, reference 16 and "IC 306 contains one or more circuits, which are electrically connected to conductive structures within IC package 308 through connectors, such as ball grid array connectors. IC 306 could be any of a number of types of integrated circuits. In one embodiment of the present invention, IC 306 is a microprocessor", Frutschy, paragraph 30),

the microprocessor having a bottom surface with a plurality of contact formations formed thereon (Chang, figure 2A – shows a set of patterns that the contacts on BGA devices can occur in)

and including a microelectronic die with an integrated circuit formed therein ("to achieve the exact alignment of the I.C. contacts and the circuit board sockets or solder pads", Spigarelli, column 1, line 66, Spigarelli is placing an integrated circuit),

the contact formations being substantially spherical , each having a surface and being electrically connected to the integrated circuit, the surface having an actual center

(Chang, figures 2A-C, the contacts of a BGA are spherical and thus have an outer edge and an actual center),

a normal brightness, area, and a dull brightness area ("The Hough locator, as known in the art, generally works better locating balls on devices that have a light background, i.e. where the device body is lighter than the balls being located", Chang, column 7, line 19, the devices Chang works with have a package background making up one area, and ball surfaces that make up a another, and they respectively have different brightnesses);

suspending the bottom surface of the microprocessor within a field a view of a CCD camera (Spigarelli, figure 1, IC – 18, is within the field of view of the camera – 10 and "The image pickup device 14 is equipped with lenses 7 for each forming an image of the electronic component 2 and CCDs 9 as one example of the image pickup devices for picking up the images formed by the lenses 7", Mitsumoto, paragraph 132);

capturing an image of the normal brightness area of at least one of the contact formations with the CCD camera (Spigarelli, figure 1, contacts are visible to the camera - 10),

the image having a width and a captured center and comprising a plurality of pixels, the captured center corresponding to the actual center, the pixels being square with sides of at least 20 percent of the width of the image ("A minimum workable ball size for purposes of detecting a ball feature is 3 pixels in diameter", Chang, column 4, line 51, 3 pixels corresponds to pixel length to contact width of around 33%); and

placing the microprocessor ("IC 306 contains one or more circuits, which are electrically connected to conductive structures within IC package 308 through connectors, such as ball grid array connectors. IC 306 could be any of a number of types of integrated circuits. In one embodiment of the present invention, IC 306 is a microprocessor", Frutschy, paragraph 30) in a socket on a motherboard ("PC board 312 could be, for example, a motherboard of a computer or other electronic system. PC board 312 acts as a vehicle to supply I/O signals to IC 306", Frutschy, paragraph 33), the socket with a plurality of conductor pads formed therein, so that the actual center of each contact formation contacts a conductor pad within the socket and the integrated circuit is electrically connected to the conductor pads ("IC package 308 is electrically coupled to socket 310 using ball grid or land grid array connections", Frutschy, paragraph 31).

6. Claims 22, 23 and 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spigarelli et al. (US 4,914,513), Chang et al. (US 6,393,942), Mitsumoto (US 2003/0133603), Swab (US2003/0066952) and Frutschy et al. (US 2003/000739) with evidentiary reference Chiu (US 2003/0150645) further in combination with Chason et al. (US 2003/0132513).

Regarding claim 22, the combination of Spigarelli, Chang, Mitsumoto, Swab and Frutschy teaches all the elements of claim 21 as given above.

The combination of Spigarelli, Chang, Mitsumoto Swab and Frutschy does not teach wherein the support is a reel with an adhesive tape attached thereto.

Chason et al. working in the related problem solving area of semiconductor packaging does teach wherein the support is a reel with an adhesive tape attached thereto ("The resultant package 40 is non-tacky and hence can be readily handled with ease prior to such placement. For example, and with reference to FIG. 5, such a package 40 can be readily placed in a variety of pick-and-place carriers, including a tape and reel carrier as shown", Chason, paragraph 19).

It would have been obvious at the time the invention was made to use the tape and reel semiconductor support taught by Chason in the alignment system of the combination of Spigarelli, Chang, Mitsumoto, Swab and Frutschy since reel and tape is an established and convenient means for presenting pick and place components (Chason, paragraph 19).

Regarding claim 23, the combination of Spigarelli, Chang, Mitsumoto, Swab, Frutschy and Chason teaches wherein the contact formations are BGA solder balls ("Ball Grid Array devices ( BGA) are surface mount devices in a package having an exterior mounting surface that consists of a set of solder balls arranged in a grid pattern", Chang, column 3, line 4).

Regarding claim 26, the combination of Spigarelli, Chang, Mitsumoto, Swab, Frutschy and Chason teaches wherein the support comprises an adhesive tape

attached to a reel ("The resultant package 40 is non-tacky and hence can be readily handled with ease prior to such placement. For example, and with reference to FIG. 5, such a package 40 can be readily placed in a variety of pick-and-place carriers, including a tape and reel carrier as shown", Chason, paragraph 19).

Regarding claim 27, the combination of Spigarelli, Chang, Mitsumoto, Swab, Frutschy and Chason teaches wherein the circuit board is a motherboard ("PC board 312 could be, for example, a motherboard of a computer or other electronic system. PC board 312 acts as a vehicle to supply I/O signals to IC 306", Frutschy, paragraph 33).

Regarding claim 28, the combination of Spigarelli, Chang, Mitsumoto, Swab, Frutschy and Chason teaches a computer in communication with ~~communication with~~ and coordinating the actions of the CCD camera and the pick-and-place head ("it will be appreciated by those skilled in the art that all of the mechanisms can be implemented in software and executed on a general purpose computer or microprocessor", Chang, column 18, line 1 and Mitsumoto, figure 17, reference 206 – control unit).

## ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THOMAS M. REDDING whose telephone number is (571)270-1579. The examiner can normally be reached on Mon - Fri 7:30 am - 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/T. M. R./
Examiner, Art Unit 2624

/Vikkram Bali/
Supervisory Patent Examiner, Art Unit 2624